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SHORT COMMUNICATION

New records and conservation of *Passiflora* L. (Passifloraceae s.s.) in Rio de Janeiro, Brazil

Michaele Alvim Milward-de-Azevedo[1,2], Natália Brandão Gonçalves Fernandes[2]

1 *Universidade Federal Rural do Rio de Janeiro, Av. Prefeito Alberto da Silva Lavinas, 1847, Centro, Três Rios, Rio de Janeiro, CEP 25802-100, Brazil*
2 *Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, Rio de Janeiro, RJ, CEP 20550-900, Brazil*

Corresponding author: Michaele Alvim Milward-de-Azevedo (michaelemilward@gmail.com)

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Abstract

Passiflora L. belongs to the family Passifloraceae *sensu stricto*, and comprises 700–750 species. There are approximately 161 known species of the family in Brazil, of which 153 belong to *Passiflora*, 89 are endemic, 83 occur in the region of the Atlantic Domain; 40 occur in Rio de Janeiro State (RJ). Using field samplings techniques and scientific collection analyses, we present here new geographic records for *Passiflora deidamioides* Harms, *P. imbeana* Sacco, *P. junqueirae* Imig & Cervi, and *P. truncata* Regel for RJ, principally in the Serra dos Órgãos National Park (PARNASO). Geographic distribution data was used to calculate the Extension of Occurrence (EOO) and Area of Occupancy (AOO) of the species. *Passiflora junqueirae*, previously considered endemic to Espírito Santo State, now has new records for RJ. *Passiflora imbeana* and *P. truncata* are extended into RJ, being recorded there for the first time in the municipality of Teresópolis. The four species are cited for the first time in PARNASO, occurring between 1,000 and 1,700 m.a.s.l. in Montane and Upper Montane Atlantic Rainforest. We provide taxonomic information, distribution maps, and the conservation status of the species.

Keywords

Atlantic Domain, conservation, endemism, geographic distribution, new occurrences, Serra dos Órgãos National Park

Passifloraceae *sensu stricto* includes woody and herbaceous climbers with tendrils, alternate leaves (with or without glands), blades entire or lobed, stipules and bracts, flowers with corona and androgynophore, as well as capsules or berry fruits (Milward-de-Azevedo et al. 2012).

Passifloraceae is a pantropical family, comprising 700–750 species distributed in 17 genera (Feuillet and MacDougal 2007). Approximately 161 species are known from Brazil, and are distributed in four genera: *Ancistrothyrsus* Harms, *Dilkea* Mast., *Mitostemma* Mast., and *Passiflora* L. Among the 153 species belonging to *Passiflora*, 89 are endemic, and 83 occur in areas within the Atlantic Domain (BFG 2018). Of the species known to Brazil, 40 occur in Rio de Janeiro State (RJ) (Milward-de-Azevedo 2014; BFG 2018), which maintains the largest fragments of preserved Atlantic Forest (Solórzano et al. 2012).

We report here the recollection of two species, and new records for *Passiflora*, which contribute to a better comprehension of the flora of the Atlantic Domain as well as Rio de Janeiro State in southeastern Brazil. We also provide taxonomic information, distribution maps, and the conservation status of the species.

Passiflora deidamioides Harms, *P. imbeana* Sacco, *P. junqueirae* Imig & Cervi, and *P. truncata* Regel were collected during periodic expeditions undertaken between May/2017 and April/2019 in the Serra dos Órgãos National Park (PARNASO) (Fig. 1). The PARNASO is situated in the municipalities of Teresópolis, Guapimirim, Magé, and Petrópolis in Rio de Janeiro State, in an area of Tropical Rainforest. *Passiflora imbeana* and *P. junqueirae* are also known from herbarium specimens deposited in the Botanical Garden of Rio de Janeiro (RB) and the Universidade Federal Rural do Rio de Janeiro (RBR) (herbarium acronyms following Thiers 2020).

The geographic distribution data found during herbarium searches (HB, HRJ, HUFSJ, R, RB), digital collections available on electronic sites (Species Link:

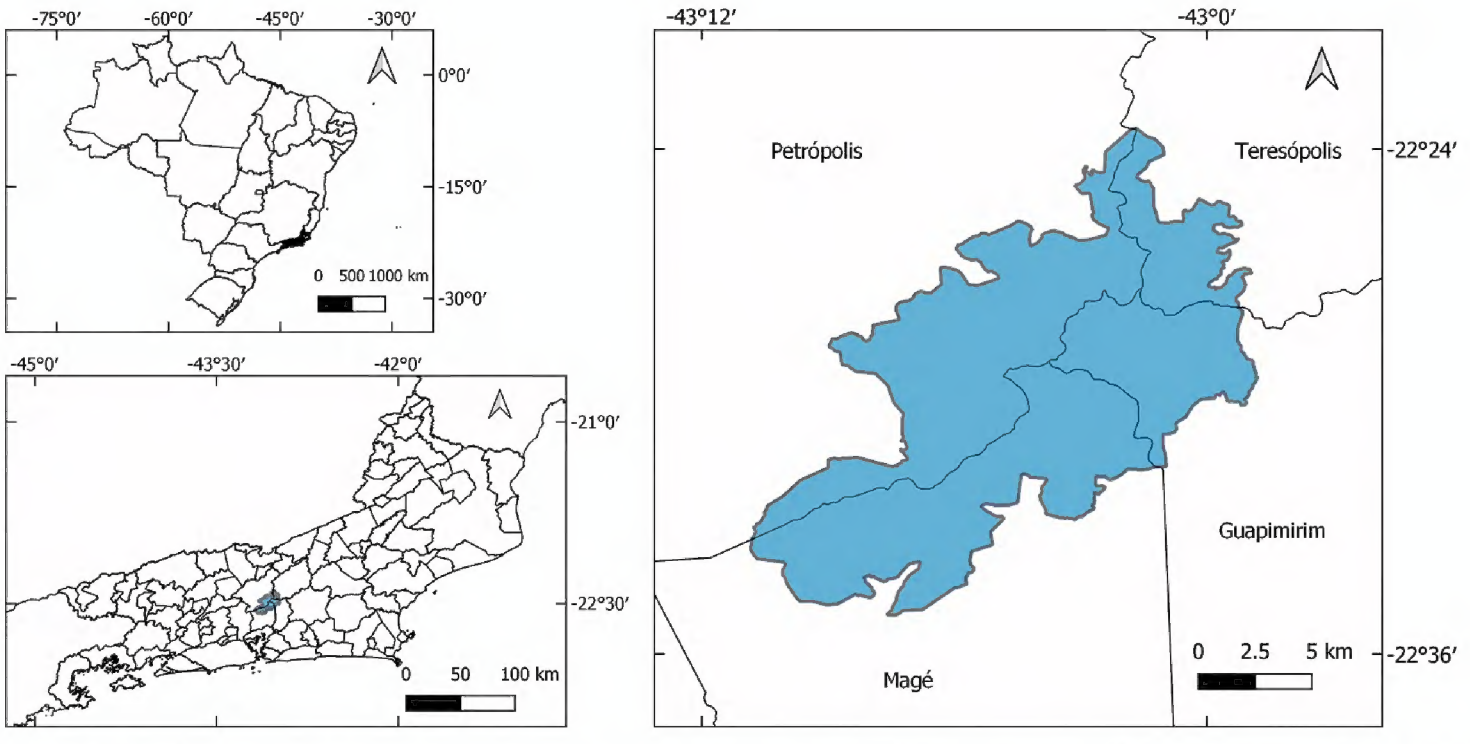

Figure 1. Delimitation of Brazil, Rio de Janeiro and Serra dos Órgãos National Park in the municipalities Petrópolis, Teresópolis, Guapimirim and Magé, Rio de Janeiro state, Brazil.

http://splink.cria.org.br/ and JABOT: http:/aplicacoes.jbrj.gov.br/jabot/v2/consulta.php), and during field expeditions were plotted and incorporated into the GeoCAT tool (http://geocat.kew.org/) that calculates the Extension of Occurrence (EOO) and the Area of Occupancy (AOO), using a 2-km grid for AOO calculation – as recommended by the International Union for Conservation of Nature (IUCN) (Bachman et al. 2011; IUCN 2019). Those calculations were used to assign the degrees of threat according to IUCN categories and criteria (2019). The species distribution map was elaborated using the online tool SimpleMappr (http://www.simplemappr.net). The vegetation classification system used here follows the Instituto Brasileiro de Geografia e Estatística (IBGE 2012).

Passiflora deidamioides **Harms, Repertorium Specierum Novarum Regni Vegetabilis 19: 57. 1923.**
Figs 2, 3

New records in PARNASO. Brazil • M.A. Milward-de-Azevedo et al. 549 (HCTR (HCTR018), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Castelos do Açú trail; -22.4781, -43.0787; 19 Jan. 2019 • M.A. Milward-de-Azevedo et al. 548 (HCTR (HCTR017), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Alto da Ventania trail; -22.5231, -43.1130; 26 Apr. 2019 • T.C. Alves 99 (RBR46,433); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park; -22.4727, -43.0780; 01 May 2019.

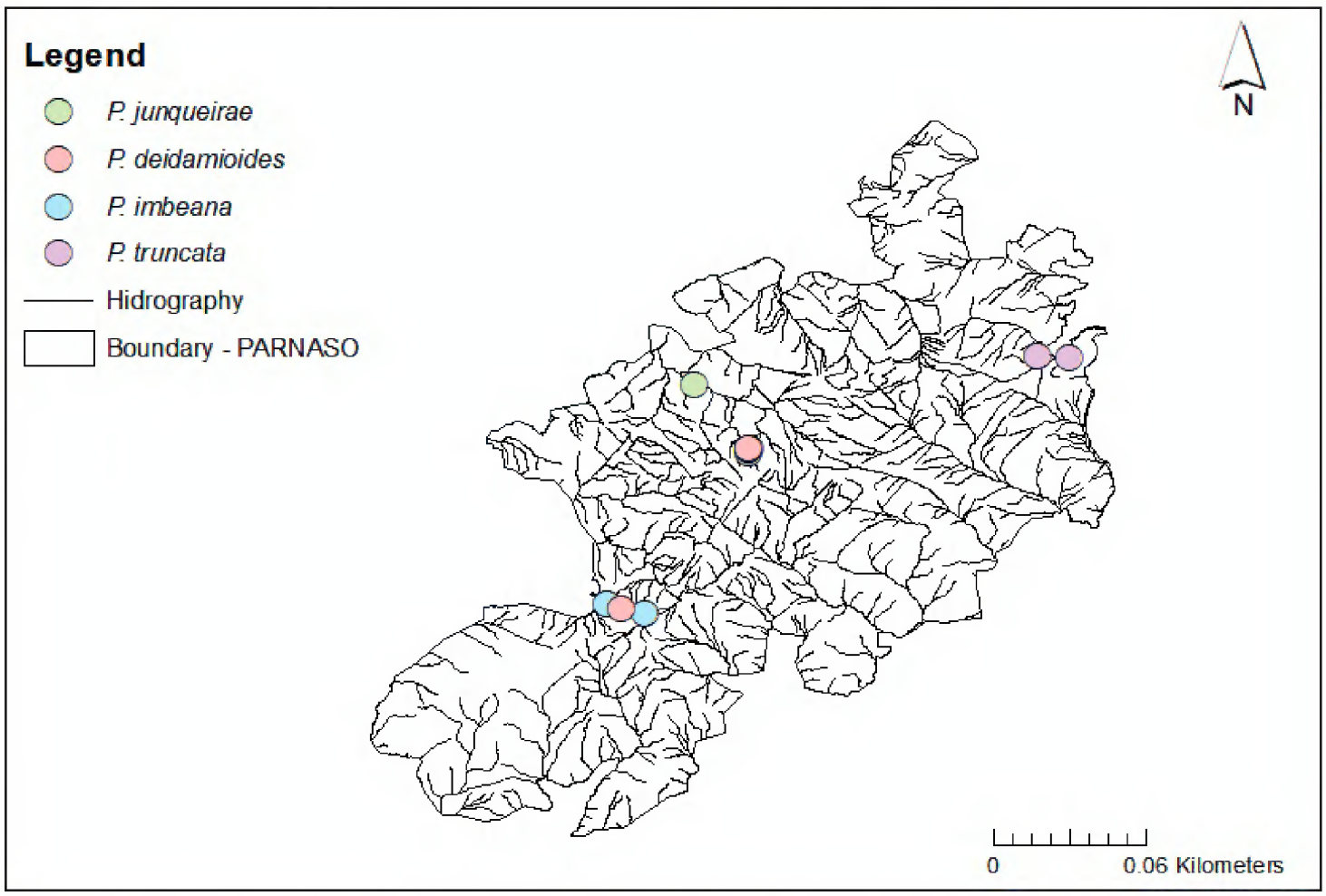

Figure 2. Occurrence of species *Passiflora deidamioides*, *Passiflora imbeana*, *Passiflora junqueirae* and *Passiflora truncata* in Serra dos Órgãos National Park, Rio de Janeiro, Brazil.

Figure 3. *Passiflora deidamioides*. Herbarium sheet of M.A. Milward-de-Azevedo et al. 548 (HCTR 017).

Herbaceous climbers. Stipules lanceolate. Leaves with petioles with two pairs of orbiculates glands; composite foliar blades, trifoliolate, leaflets elliptic, chartaceous, acute at apex, obtuse to oblique at base. Bracts linear-lanceolate. Flower with calyx tube short-campanulate, sepals and petals oblong-lanceolate, corona 3–5 series of filaments, ovary ellipsoidal, glabrous. Fruits a berry, ellipsoidal. Seeds foveolate.

Endemic to southeastern Brazil, *P. deidamioides* was collected for the first time in Teresópolis (RJ) by A.C. Brade 9850 (MO3,296,116, R22,732) in 1929, and in the Serra da Maria Comprida Environmental Protection Area in Petrópolis (RJ) in 2009 by R. Borges 994 (RB488,169) – both areas near or adjacent to the PARNASO.

It occurs in areas of Montane and Upper Montane Tropical Rainforest, between 1,300 and 1,700 m.a.s.l. in the PARNASO, and was recollected after 10 years in the municipality of Petrópolis. The species also occurs in the municipalities of Nova Friburgo and Paraty, also in RJ.

Based on our preliminary analyses, *P. deidamioides* can be considered "Endangered" (EN), with an AOO of 76 km^2 and an EOO of 57,674 km^2, a conservation status characterized as B2ab(i,ii,iii), based on our preliminary analyses, with 28 known occurrence localities. Although the vast majority of known collections are from protected areas, the species is infrequent in the field, so that a more complete IUCN assessment will be needed.

Passiflora deidamioides is found in states of Minas Gerais, Rio de Janeiro, and São Paulo, within the Brazilian Atlantic Forest domain, mainly in environmental preservation areas at between 890 and 1,324 m.a.s.l. (Nunes 2009). No specimens were found, however, in the PARNASO at altitudes below 1,300 m.a.s.l. Milward-de-Azevedo (2007) mentioned the occurrence of *P. deidamioides* in Minas Gerais State in areas of rupestrian vegetation. Although not officially indicated as threatened, its endemism and high habitat specificity make it susceptible, and it is considered vulnerable in São Paulo State (Bernacci 2003).

Passiflora imbeana **Sacco, Sellowia 18: 42, figs 1, 2. 1966.**
Figs 2, 4, 5

New records. Brazil • C. Baez et al. 1,062 (RB 666,167); Rio de Janeiro, Teresópolis, Três Picos Estadual Park, Morro Cabeça de Dragão; -22.327, -42.7202; 05 Oct. 2016.

New records in PARNASO. Brazil • M.A. Milward-de-Azevedo et al. 554 (HCTR (HCTR023), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Castelos do Açú trail (Ajax); -22.4807, -43.0784; 19 Jan. 2019 • M.A. Milward-de-Azevedo et al. 564 (HCTR (HCTR032), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Alto Ventania trail; -22.5219, -43.1169; 26 Apr. 2019 • T.C. Alves 95 (RBR 46,446); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park; -22.4813, -43.0788; 01 May 2019.

Herbaceous climbers. Stipules reniform. Leaves with petioles with one-two stipitate glands; simple foliar blades, hastate, coriaceous, acute to obtuse at apex, retuse, cordate at base. Bracts ovate. Flowers with calyx tube short-campanulate, sepals and petals lanceolate, corona 3 series of filaments, ovary ovate, glabrous. Fruits a berry, globose. Seeds foveolate.

Passiflora imbeana is endemic to RJ. It occurs primarily in the northern region of that state in the municipalities of Cardoso Moreira, Macaé, Santa Maria Madalena, and Santo Antônio do Imbé, as well as in the central region, in the municipalities of Nova Iguaçú and Petrópolis. The species is now also reported from the municipality of Teresópolis.

Although reported as occurring in the PARNASO by the CNCFlora (2012), that occurrence was not mentioned in the Endemic Flora Red Book of Rio de Janeiro State

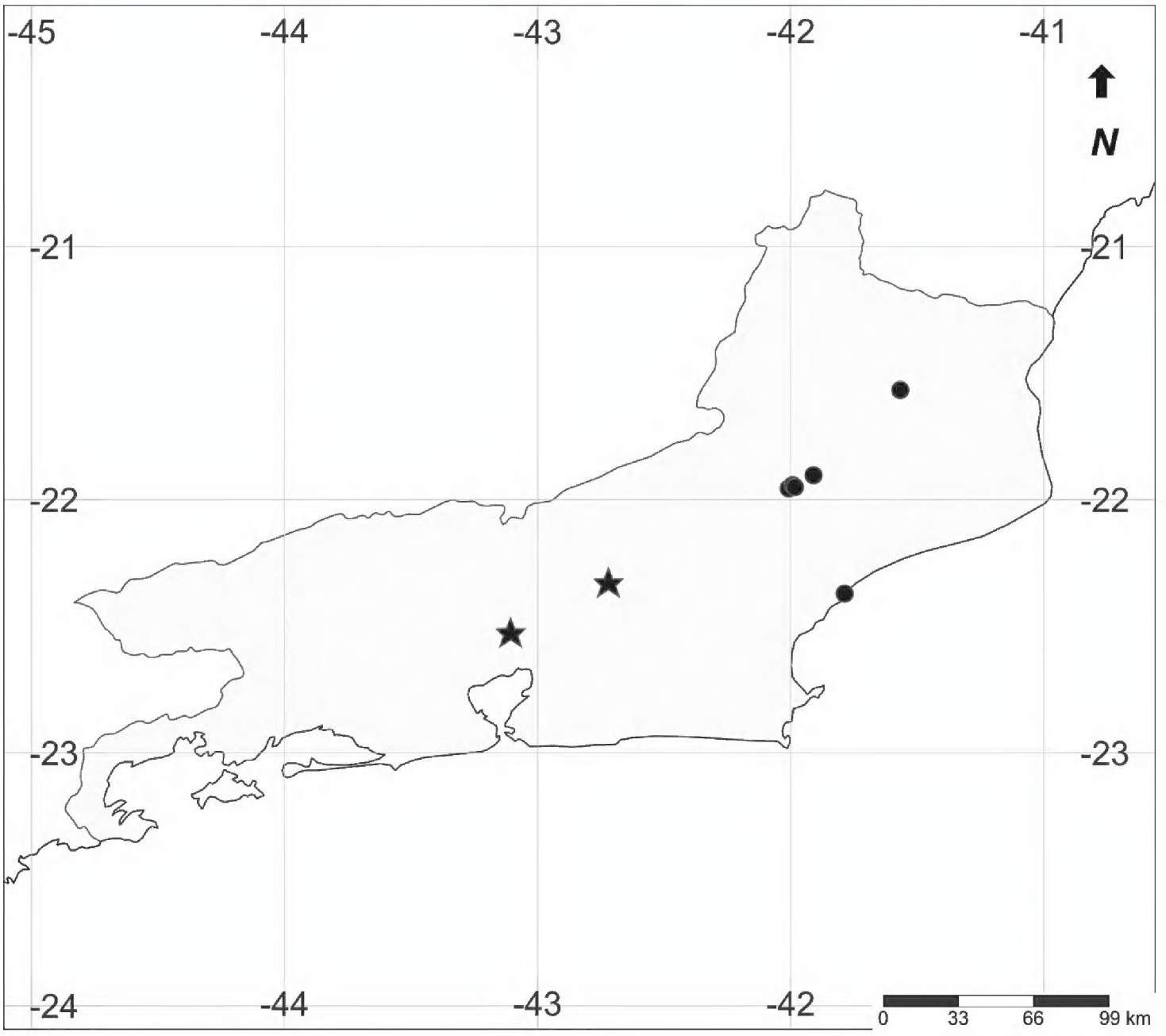

Figure 4. Geographical distribution map of *Passiflora imbeana*. Legends: (•) occurrence points known, (★) new occurrence points.

(Mezzonato-Pires et al. 2018a). This report is the first record for the PARNASO, and it was recollected after 32 years in Petrópolis. *Passiflora imbeana* was first collected in Petrópolis in 1986 by R.R. Oliveira 924 (RB693,622), as was noted by Cervi (1997).

This species presents a Brazilian Atlantic Forest distribution pattern, occurring in areas of Montane and Upper Montane Atlantic Rainforest between 1,300 and 1,700 m.a.s.l. The species can be considered "Endangered" (EN), as it has an AOO of 40 km^2 and an EOO 4,023 km^2, a conservation status characterized as B1ab(i,ii,iii)+2ab(i,ii,iii), based on our preliminary analyses, with 26 known collection localities. Herbarium collections of the species are scarce, although all are from protected areas. As the species is infrequent in the field, a more detailed IUCN assessment will be needed.

Passiflora imbeana occurs in protected areas, with a very restricted habitat range between Upper Montane Atlantic Rainforest and high-altitude areas (CNCFlora 2012). The species is found in transition environments between Rainforest and high

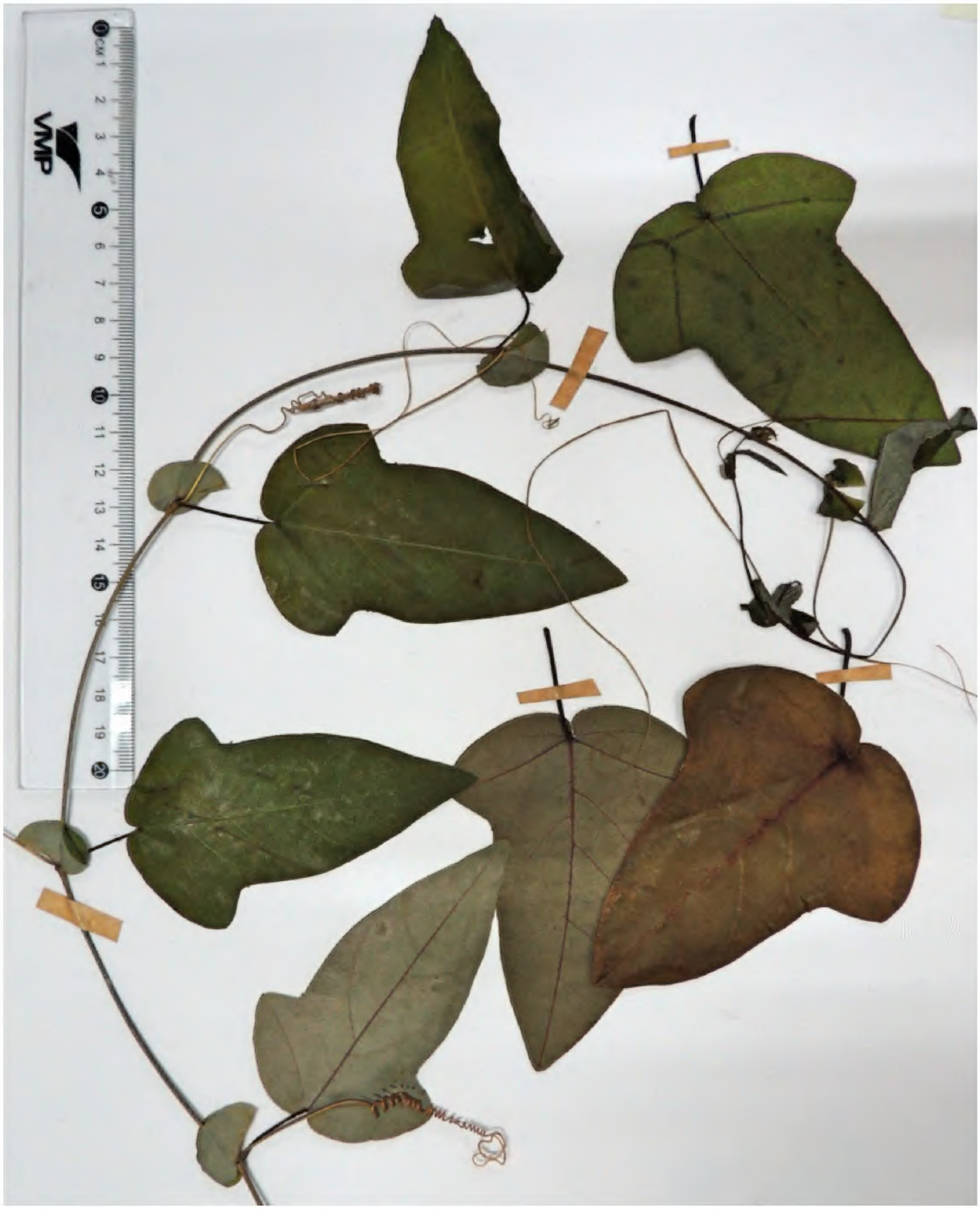

Figure 5. *Passiflora imbeana*. Herbarium sheet of M.A. Milward-de-Azevedo et al. 554 (HCTR 023).

altitude areas in the PARNASO. It is included in Annex 1 of the List of Endangered Flora Species (MMA 2008) and Ordinance No. 443 of December 17, 2014 – the Official Brazilian National List of Endangered Flora Species (MMA 2014). It is characterized by IUCN criteria as EN B1ab(iii) by CNCFlora (2012), and as EN B1ab(i,ii,iii)+2ab(i,ii,iii) by Mezzonato-Pires et al. (2018a).

Passiflora junqueirae **Imig & Cervi, Phytotaxa 186 (5): 292–296. 2014.**
Figs 2, 6, 7

New records. Brazil • M.A. Milward-de-Azevedo et al. 496 (HCTR (HCTR086), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Véu da Noiva trail; -22.4625, -43.0933; 02 Feb. 2018 • (RB 419,979); Rio de Janeiro, Santa Maria Madalena • C.H.R. de Paula et al. 739 (RB 440,495); Rio de Janeiro, Teresópolis, Venda Nova, Fazenda das Palmeiras; 22°17'53"S, 42°53'27"W; 20 Mar. 2005.

Herbaceous climbers. Stipules reniform. Leaves with petioles with three-six stipitate glands; simple foliar blades, trilobate, chartaceus, acute-acuminate at apex, truncatus at base. Bracts linear. Flowers with calyx tube short-campanulate, sepals and petals oblong-lanceolate, corona with 7 series of filaments, ovary oblong, tomentose. Fruits a berry, oblong-ovate. Seeds foveolate.

Endemic to Brazil, *P. junqueirae* was only known to occur in Espírito Santo State (Imig and Cervi 2014). It is now recorded from RJ, in the municipalities of Petrópolis, Santa Maria Madalena, and Teresópolis (Fig. 6). The species presents a disjunct distribution pattern in the Brazilian Atlantic Forest.

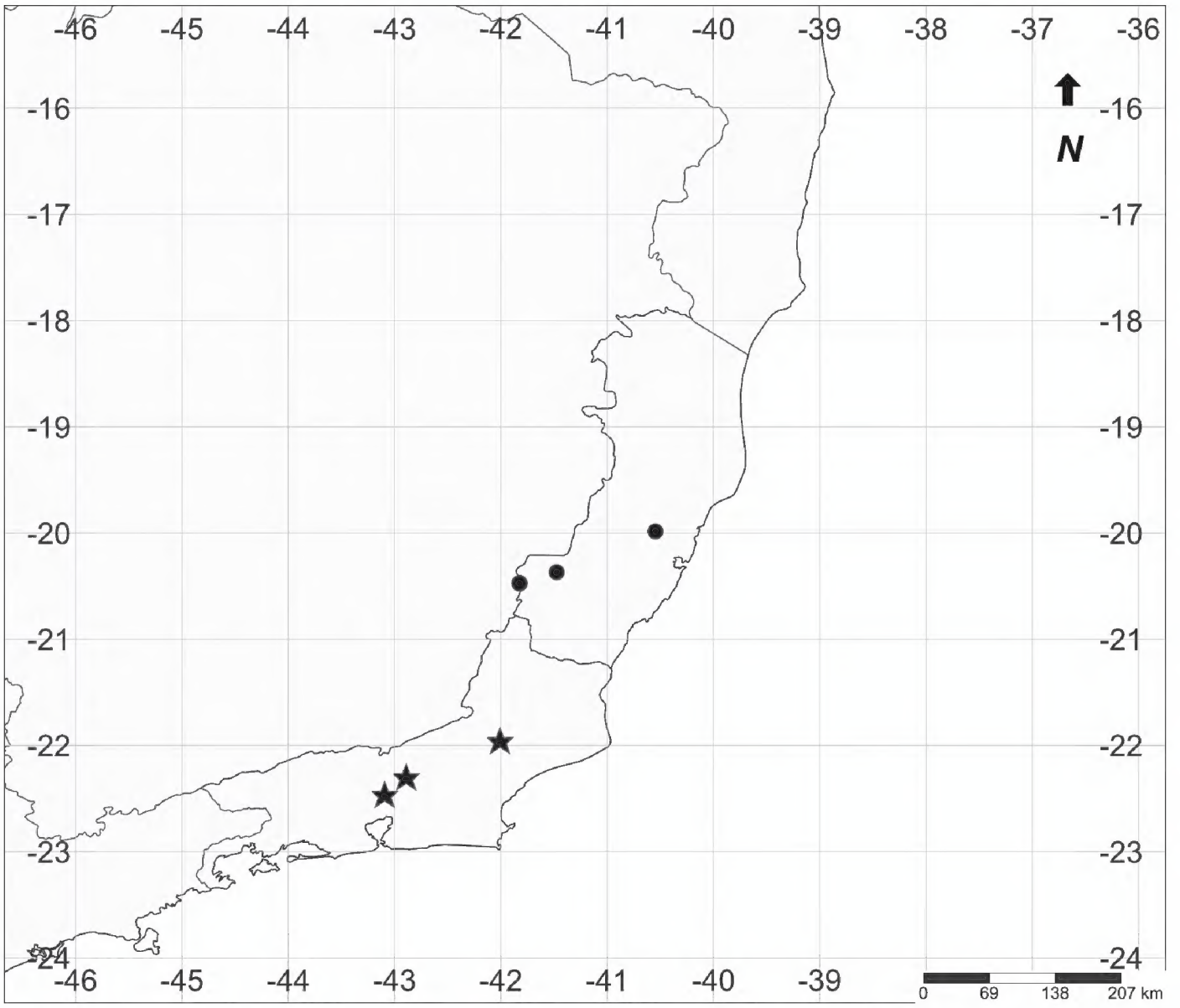

Figure 6. Geographical distribution map of *Passiflora junqueirae*. Legends: (•) occurrence points known, (★) new occurrence points.

Figure 7. *Passiflora junqueirae*. Herbarium sheet of M.A. Milward-de-Azevedo et al. 540 (HCTR 009).

This species can be considered "Endangered" (EN), with an AOO of 20 km^2 and an EOO of 11,754 km^2, a conservation status characterized as B2ab(i,ii,iii), based on our preliminary analyses, with 10 known collection localities. Herbarium collections are scarce, although most are from protected areas. As it is infrequent in the field, a more complete IUCN assessment will be needed.

Passiflora junqueirae is morphologically similar to *P. amethystina* Mikan and *P. loefgrenii* Vitta, as described by Imig and Cervi (2014) – and many specimens have been erroneously identified as *P. amethystina*. The differences between species are that *P. junqueirae* plants are sparsely hairy, with lobed leaves and bracts,

an absence of glands in the leaf sinuses, sepals with dorsal awns 2.0–3.5 cm long, corona with seven series of filaments, and ovary tomentose (Imig and Cervi 2014).

In the original description of the species, Imig and Cervi (2014) reported it as occurring at elevations between 1,400 and 2,100 m.a.s.l. in the Caparaó National Park, Espírito Santo State (Imig and Cervi 2014). It was found between 1,000 and 1,100 m.a.s.l. in the PARNASO, indicating that *P. junqueirae* is adapted to Montane and Upper Montane Rainforest environments.

Passiflora truncata **Regel, Gartenflora 8: 356, t. 276. 1858.**
Figs 2, 8, 9

New records. Brazil • N.B.G. Fernandes et A.M. Moraes 2 (HCTR (HCTR123), RBR); Rio de Janeiro, Teresópolis, Serra dos Órgãos National Park, 360° trail; -22.4552, -42.9886; 11 Jan. 2019 • N.B.G. Fernandes et A.M. Moraes 3 (HCTR (HCTR124), RBR); Rio de Janeiro, Teresópolis, Serra dos Órgãos National Park, Suspensa trail; -22.4522, -43.0005; 12 Jan. 2019.

Herbaceous climbers. Stipules falciform. Leaves with petioles with one pair of auriculate glands; simple foliar blades, trilobate, chartaceus, truncate to slightly

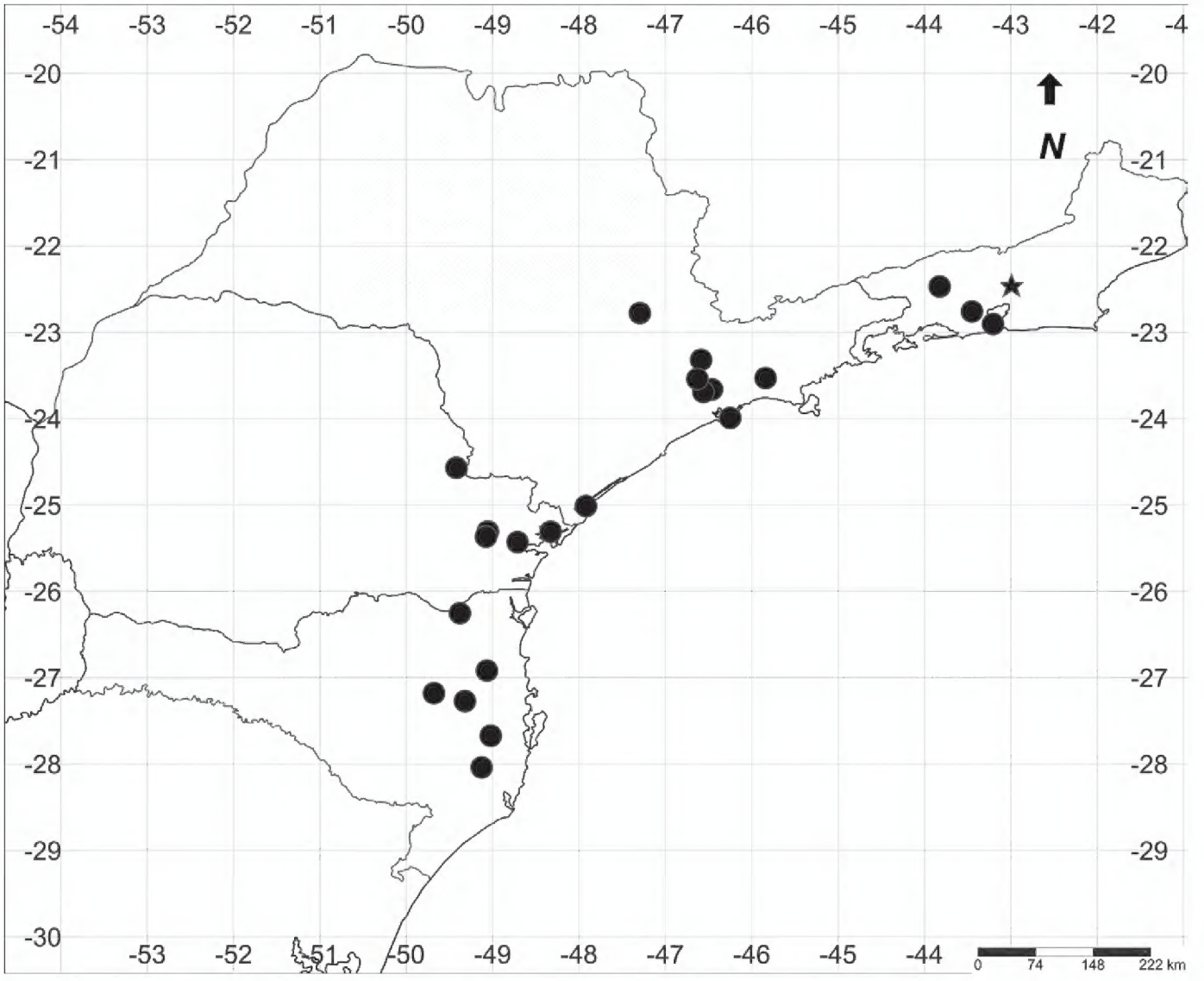

Figure 8. Geographical distribution map of *Passiflora truncata*. Legends: (•) occurrence points known, (★) new occurrence points.

Figure 9. *Passiflora truncata* in Serra dos Órgãos National Park, Teresópolis, Rio de Janeiro, Brazil.

3-lobed towards the apex, rounded at base. Bracts triangular-subulate. Flowers with calyx tube short-campanulate, sepals and petals oblong-lanceolate, corona with 2 series of filaments, ovary ellipsoidal, pubescent. Fruits a berry, globose to subglobose. Seeds transversal sulcate.

Endemic to Brazil, *P. truncata* is now reported from the municipality of Teresópolis (RJ). *Passiflora truncata* is found in the states of Rio de Janeiro, São Paulo, Paraná, and Santa Catarina, with a Brazilian Atlantic Forest distribution pattern, at between 500 and 1,300 m.a.s.l. It is exclusive to Submontane (Milward-de-Azevedo and Baumgratz 2004) and Montane Atlantic Rainforest in the Serra do Mar mountain range (Milward-de-Azevedo et al. 2012). It occurs between 1,150 and 1,315 m.a.s.l. in the PARNASO.

The species can be considered "Endangered" (EN), with an AOO of 96 km^2 and an EOO 191,079 km^2, a conservation status characterized as B2ab(i,ii,iii), based on our preliminary analyses, with 25 known collection localities. As the species is infrequent in the field, its herbarium collections are quite sparse, and it is only known from protected areas, a full IUCN assessment will be needed.

These new records expand the known distributions of *P. imbeana*, *P. junqueirae*, and *P. truncata*, and the recollections of *P. deidamioides* and *P. imbeana* demonstrates the importance of protected areas [including, for example, the new records of *Passiflora* published by Mezzonato-Pires et al. (2017), Mezzonato-Pires et al. (2018b), Milward-de-Azevedo (2019), Silva et al. (2018), and Silva et al. (2020)]. The four species are cited here for the first time in the PARNASO, occurring at elevations between 1,000 and 1,700 m.a.s.l. in Montane and Upper Montane Atlantic Rainforest.

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Appendix

Material used for figures. *Passiflora deidamioides* Harms: Brazil • M.A. Milward-de-Azevedo et al. 548 (HCTR (HCTR017), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Alto da Ventania trail; -22.5231, -43.1130; 26 Apr. 2019. *Passiflora imbeana* Sacco: Brazil • M.A. Milward-de-Azevedo et al. 554 (HCTR (HCTR023), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Castelos do Açú trail (Ajax); -22.4807, -43.0784; 19 Jan. 2019. *Passiflora junqueirae* Imig & Cervi: Brazil • M.A. Milward-de-Azevedo et al. 540 (HCTR (HCTR009), RBR); Rio de Janeiro, Petrópolis, Serra dos Órgãos National Park, Véu da Noiva trail; -22.4627, -43.0932; 18 Jan. 2019.